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(54) **GAS-PERMEABLE AND WATERPROOF NONWOVEN FABRIC AND PROCESS FOR ITS PRODUCTION.**

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## Description

### 1. Field of the Invention

5 This invention relates to a porous waterproof nonwoven fabric having both of gas-permeability and waterproofness and a process for producing the same.

### 2. Description of the Related Art

10 The prior art directed to porous waterproof nonwoven fabric has mostly been carried out mainly by subjecting a gas-permeable nonwoven fabric substrate to coating process with a resin to form a resin film on the substrate and thereby impart a superior waterproofness thereto. However, according to such a process, it has been difficult to impart a sufficient gas-permeability and the resulting product has been difficult to be regarded as a substantially gas-permeable waterproof nonwoven fabric, and further, dampness  
15 due to sweat and moisture excreted from the body at the time of its wearing has given a disagreeable feeling.

As a technique for solving this problem, a process referred to as wet coating process has been known. For example, Japanese patent application laid-open No. Sho 56-26076 discloses a process wherein a solution of an urethane polymer dissolved in a polar organic solvent is coated onto a substrate, followed by  
20 dripping the resulting material in a water bath to remove the polar solvent and thereby form a finely porous polyurethane film having a gas-permeability. However, the process has drawbacks that the production steps are complicated and the allowable ranges of the production conditions are narrow.

According to the process, since a polyurethane resin which is an expensive raw material is used and particular processing conditions and processing equipments are required, the resulting film is so expensive  
25 that the resulting product can be used only for limited high-class clothes; hence the product has a drawback that it cannot be used for example for disposable uses or similar uses.

Further, gas-permeable waterproof nonwoven fabrics are required to have a good feeling in view of their uses; hence conventional products have also been insufficient in this aspect.

Furthermore known calender processes such as those described in US-A-4438167, FR-A-2358439, DE-  
30 A-824632, GB-A-1240586 do not provide suitable products.

An object of the present invention is to provide a porous composite nonwoven fabric which is superior in both of the properties of gas-permeability and waterproofness.

Another object of the present invention is to provide a porous composite nonwoven fabric which can be produced under simple processing conditions and using simple processing equipments.

35 Still another object of the present invention is to provide a porous composite nonwoven fabric which can be produced at cheap cost and hence is suitable to disposable uses.

Further still another object of the present invention is to provide a porous nonwoven fabric having superior mechanical strengths.

Furthermore still another object of the present invention is to provide a porous nonwoven fabric having a  
40 superior feeling.

Still another object of the present invention is to provide a process for producing a porous nonwoven fabric having the above-mentioned properties.

## SUMMARY OF THE INVENTION

45 In accordance with the present invention, there are provided a porous composite nonwoven fabric which comprises a thermoplastic film comprising 100 parts by weight of a thermoplastic resin and 1 to 50 parts by weight of an organic filler and a nonwoven fabric, the thermoplastic film having fine pores formed by calender processing; a process for producing a porous composite nonwoven fabric which comprises  
50 subjecting to calender processing, a thermoplastic film comprising 100 parts by weight of a thermoplastic resin and 1 to 50 parts by weight of an organic filler, followed by applying a nonwoven fabric onto the resulting film; a process for producing a porous composite nonwoven fabric which comprises applying a thermoplastic film comprising 100 parts by weight of a thermoplastic resin and 1 to 50 parts by weight of an organic filler onto a nonwoven fabric, followed by subjecting the resulting material to calender processing  
55 and a process for producing a porous composite nonwoven fabric which comprises coating a nonwoven fabric with a thermoplastic resin composition comprising 100 parts by weight of a thermoplastic resin and 1 to 50 parts by weight of an organic filler, followed by subjecting the resulting material to calender processing.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

As the thermoplastic resin used in the present invention, those which match the nonwoven fabric in the aspect of its strengths, waterproofness, feeling, appearance, cost, etc. are used.

Concrete examples thereof are acrylic resins, urethane resins, synthetic rubbers, ethylene-vinyl acetate copolymer resins, etc.

Examples of acrylic resins are polymers of alkyl acrylates or alkyl methacrylates such as methyl acrylate, methyl methacrylate, ethyl acrylate, ethyl methacrylate, propyl acrylate, propyl methacrylate, butyl acrylate, butyl methacrylate, pentyl acrylate, pentyl methacrylate, hexyl acrylate, hexyl methacrylate, heptyl acrylate, heptyl methacrylate, octyl acrylate, octyl methacrylate, octadecyl acrylate, octadecyl methacrylate, etc. and copolymers of the foregoing esters with ethylenic unsaturated aromatic monomers such as styrene,  $\alpha$ -methylstyrene, vinyltoluene, etc., unsaturated nitriles such as acrylonitrile, methacrylonitrile, etc., vinyl esters such as vinyl acetate and vinyl propionate, ethylenic unsaturated carboxylic acids such as acrylic acid, methacrylic acid, itaconic acid, fumaric acid, maleic anhydride, crotonic acid, etc., hydroxyalkyl ethylenic unsaturated carboxylates such as 2-hydroxypropyl acrylate, 2-hydroxyethyl methacrylate, etc., glycidyl ethylenic unsaturated carboxylates such as glycidyl acrylate, glycidyl methacrylate, etc., and acrylamide, methacrylamide, N-methylol acrylamide, N-methylol methacrylamide, N-butoxymethyl acrylamide, diacetone acrylamide, etc.

Examples of urethane resins are polyester or polyether urethane elastomers prepared from polyesters or polyether diols and diisocyanates.

Polyesters referred to herein are those obtained by polycondensation of polycarboxylic acids with polyols.

Examples of the polycarboxylic acids referred to herein are aliphatic saturated dibasic acids such as malonic acid, succinic acid, glutaric acid, adipic acid, azelaic acid, sebacic acid, hexahydrophthalic anhydride, etc., aliphatic unsaturated dibasic acids such as maleic acid, maleic anhydride, fumaric acid, itaconic acid, citraconic acid, etc., aromatic dibasic acids such as phthalic anhydride, phthalic acid, terephthalic acid, isophthalic acid, etc., and lower alkyl esters of the foregoing.

Examples of the polyols referred to herein are diols such as ethylene glycol, 1,2-propylene glycol, 1,3-propylene glycol, 1,3-butylene glycol, 1,4-butylene glycol, 1,6-hexanediol, neopentyl glycol, diethylene glycol, dipropylene glycol, hydrogenated bisphenol A, adduct of bisphenol A to ethylene oxide, adduct of bisphenol A to propylene oxide, etc., and triols such as glycerine, trimethylolpropane, trimethylolethane, etc.

Examples of polyether diols are polyethylene glycol, polypropylene glycol, polytetramethylene glycol, polycaprolactone, etc., and these may also be used as polyols which are used in the preparation of polyesters.

Examples of diisocyanates to be reacted with the above polyesters or polyether diols are hexamethylene diisocyanate, isophorone diisocyanate, tolylene diisocyanate, diphenylmethane diisocyanate, xylene diisocyanate, tetramethylxylene diisocyanate, etc.

As the synthetic rubbers, copolymers of at least one of styrene, methyl methacrylate and acrylonitrile with butadiene may be used. If necessary, copolymers of the foregoing with a functional group monomer such as ethylenic unsaturated carboxylic acids such as acrylic acid, methacrylic acid, itaconic acid, fumaric acid, maleic anhydride, crotonic acid, etc., hydroxyalkyl ethylenic unsaturated carboxylates such as 2-hydroxypropyl acrylate, 2-hydroxyethyl methacrylate, etc., glycidyl ethylenic unsaturated carboxylates such as glycidyl acrylate, glycidyl methacrylate, etc. and acrylamide, methacryl amide, N-methylol acrylamide, N-methylol methacrylamide, N-butoxymethyl acrylamide, diacetone acrylamide, etc.

The filler used in the present invention refers to organic fine particles. The form thereof is not always necessary to be spherical, but it may be hollow, flat, acicular or porous, that is, it has no particular limitation. The organic fillers refer to fine particles of thermoplastic resins or thermoset resins. Examples thereof are fine particles of fluorine resins, silicone resins, polyethylene, polypropylene, ethylene-vinyl acetate resins, nylon, polyester resins, polyamide resins, polystyrene resin, acrylic resins, cellulose acetate, butyrate resins, urea resins, phenolic resins, epoxy resins, etc. Concrete examples of such fillers are U PEARL (urea resin; trademark of a product made by Mitsui Toatsu Chemicals, Inc.), BARINAX (polyester resin; trademark of a product made by Mitsui Toatsu Chemicals, Inc.), KPL (fluorine resin; trademark of a product made by Kitamura Company), FLO-THENE (polyethylene resin; trademark of a product made by Seitetsu Kagaku Company), etc. The resins are not limited particularly to the above resins as far as fine particles can be made therefrom. The above fillers may be used alone or in adequate admixture.

In view of waterproofness, the filler itself is preferred to be water-repellent, and fluorine resins, silicone resins, polyethylene, polypropylene, etc. are more suitable.

The particular size of the filler is preferably in the range of 1 to 50  $\mu\text{m}$ , more preferably 3 to 40  $\mu\text{m}$  in terms of the average particle size. Further, it is preferred to have the same thickness as or larger than that of the resulting porous waterproofing film. The average particle size referred to herein means the size of a secondary particle regarded as one particle in the case where particles agglomerate. Further, as to the  
 5 particle size, when the filler particle is spherical, it refers to the diameter of the spherical particle, while when the particle is non-spherical, it refers to a diameter calculated from that of a spherical body having the same volume as that of the non-spherical particle.

The quantity of the filler used in the present invention is in the range of 1 to 50 parts by weight, preferably 5 to 30 parts by weight based on 100 parts by weight of the thermoplastic resin. If the quantity is  
 10 less than 1 part by weight, no sufficient air permeability is obtained, while if it exceeds 50 parts by weight, it is difficult to retain the strength as the nonwoven fabric and also the resulting product is inferior in the waterproofness.

The reason of using a nonwoven fabric in the present invention is that it is possible to reduce the thickness of waterproofing fabric and also make it lightweight and further the resulting product has a  
 15 superior feeling. Further, the product is cheap and hence suitable to disposable use applications. If other bases such as clothes, etc. are used, the resulting product is insufficient particularly in feeling and unsuitable to use applications such as diaper where the resulting product is contacted directly with skin.

The nonwoven fabric referred to in the present invention may be wet nonwoven fabric, spun-bonded nonwoven fabric, dry nonwoven fabric, stitch-bonded nonwoven fabric, needle-punched nonwoven fabric,  
 20 spun rayon nonwoven fabric, hot-melt-adhesive nonwoven fabric, etc. and although it is not particularly limited to these, spun-bonded nonwoven fabric is preferred in that the fabric is superior in the gas-permeability and strength and also since no treatment with oiling agents participates in the production process, it is possible to make the best use of properties characteristic of used fibers.

Examples of fibers constituting such nonwoven fabrics are polyester fibers, nylon fibers, polyacrylic  
 25 fibers, polyolefin fibers, rayon fibers, etc., and these fibers may be used alone or in admixture.

As to the form of the porous composite nonwoven fabric, the fabric is a material obtained by arranging a nonwoven fabric on at least one surface of a thermoplastic film, and as to the form of the nonwoven fabric, the fabric may be a single nonwoven fabric or a material obtained by integrating a plurality of nonwoven fabrics composed of the same or different kinds of fiber layers in a conventional manner. For  
 30 example, a sandwich type porous waterproof nonwoven fabric obtained by arranging a nonwoven fabric composed of hydrophilic fibers on one surface of a resin composition film and a nonwoven fabric composed of hydrophobic fibers on the other surface thereof may be suitable for uses as clothes, but a number of variations may be possible depending on the uses and objects thereof, and there is no particular limitation thereto.

The basis weight of the nonwoven fabric also has no particular limitation, but it is preferably in the  
 35 range of 10 to 120  $\text{g/m}^2$ . If it is less than 10  $\text{g/m}^2$ , the resulting material does not constitute the form of nonwoven fabric.

As to the process for producing the porous composite nonwoven fabric of the present invention, the following representative processes may be considered:

A first process is carried out by forming a film composed of a thermoplastic resin containing a filler,  
 40 followed by imparting gas-permeability thereto according to calender processing and then applying the resulting material onto a nonwoven fabric. A second process is carried out by forming a film composed of a thermoplastic resin containing a filler, applying the film onto a nonwoven fabric and then imparting gas-permeability to the resulting material according to calendering processing. A third process is carried out by  
 45 directly coating a nonwoven fabric with a thermoplastic resin containing a filler and then subjecting the resulting material to calender processing to impart gas-permeability to the calendered material. In the aspect of steps, the third process is preferred in that an adhesion step is unnecessary, but even the second process has an advantage that the calender processing and the adhesion step can be simultaneously carried out. Further, the first and second processes are effective particularly in the case of a nonwoven  
 50 fabric having a low basis weight and wide-meshes due to which no uniform coating can be obtained when the fabric is directly coated.

As to the process for forming a film in the first and second processes, it is necessary to choose an adequate film-making process depending on the characteristics of the thermoplastic resin. For example, as to acrylic resins, urethane resins, synthetic rubbers, etc., it has often been commercially employed to form  
 55 a film in the form of a solution in solvent or in the form of an aqueous dispersion such as latex, emulsion, etc. according to coating process. At that time, if necessary, a curing agent may be contained therein in order to improve the coating strength of the thermoplastic resin and improving the water resistance thereof. Particularly when the thermoplastic resin has a functional group in the solvent solution or the aqueous

dispersion, a curing agent is often used at the same time. As the curing agent, melamine resins, urea resins, epoxy resins, metal chelate compounds, isocyanate compounds, aziridine compounds, etc. may be used, if necessary.

If the case of coating process, for example, the solvent solution or aqueous emulsion of the thermoplastic resin may be applied directly onto a release paper or a release film by means of a coater such as knife coater, bar coater, roll coater, flow coater or the like, followed by drying the resulting material to form a coating and then stripping the resulting coating from the release paper or the release film to obtain the coating.

In the third process, coating is carried out directly onto a nonwoven fabric, but the coating may be carried out in the same manner as in the above process. It is possible to use a curing agent at the same times as in the above process.

The filler is necessary to choose also taking into account the above production process of the waterproof nonwoven fabric. For example, in the case where it is produced using a solvent solution, it is necessary to choose a filler insoluble in the solvent used. In the case where it is produced using an aqueous dispersion, it is necessary to choose a filler which is unchanged in the properties by water. As described above, an adequate filler varies depending on the state employed.

Imparting of the gas-permeability is carried out by calender processing. Namely, an external force is applied onto a thermoplastic resin composition film having a filler mixed with and dispersed in a thermoplastic resin according to calender processing to form clearances between the filler and the thermoplastic resin film and also break the surface of the continued film, whereby continued fine pores are prepared to obtain the gas-permeability.

As to the gas-permeability, usually the higher the linear pressure of calender and the larger the number of times of calendering, the easier the imparting of the gas-permeability. Thus, the control of the gas-permeability required may be easily effected by choosing the film thickness, the kind, average particle diameter and added quantity of the filler, calender conditions, etc. Usually, the calender temperature is preferably in the range of 0° to 150°C, more preferably 15° to 100°C and the linear pressure is preferably in the range of 9.8 to 19620 N, more preferably 98.1 to 981 N. The calender velocity is preferably in the range of 5 to 200 m/min., more preferably 30 to 100 m/min. Further, the number of times of the calendering has no particular limitation, but usually it is in the range of once to 10 times.

The diameter of the gas-permeable holes of the thus processed porous waterproof nonwoven fabric is preferably in the range of 0.1 to 10  $\mu\text{m}$ , more preferably 0.5 to 5  $\mu\text{m}$ , and such a range is practically suitable since the gas-permeability and the waterproofness are well balanced in the range.

The control of the diameter of the gas-permeable holes may be carried out by adequately choosing the film thickness, the kind, average particle diameter and added quantity of the filler, calender conditions, etc. as described above.

Further, in order to improve the waterproofness and water-repellency, water-repelling treatment may be carried out after the calender processing, if necessary. The water-repelling treatment may be carried out according to impregnation process, patting process, coating process, etc., using an aqueous dispersion of e.g. fluorine repellant, silicone repellant, etc., followed by drying and heat treatment to thereby obtain a water-repellent effect.

The present invention will be described in more detail by way of Examples, but it should not be construed to be limited thereto.

#### Example 1

As the resin used in this Example, the following resin was produced and used as a sample for the subsequent tests:

Distilled water (150 parts by weight), potassium persulfate (0.5 part by weight), sodium dodecylbenzene sulfonate (1.0 part by weight) and acrylamide (3 parts by weight) were fed in a flask, followed by raising the temperature up to 70°C under  $\text{N}_2$  purging, thereafter continuously dropwise adding butyl acrylate (66 parts by weight), acrylonitrile (23 parts by weight), acrylic acid (4 parts by weight) and hydroxyethyl methacrylate (4 parts by weight) to complete polymerization and thereby obtain an acrylic emulsion having a solids content of 40 %.

A mixture consisting of the above-mentioned acrylic emulsion of butyl acrylate, etc. (solids content: 40 %) (250 parts by weight), FLO-THENE (tradename of product made by Seitetsu Kagaku Company; average particle diameter, 25  $\mu\text{m}$ ) as a polyethylene filler (10 parts by weight) and a defoamer (1.0 part by weight) was dispersed by means of a disperser, followed by thickening the dispersion with aqueous ammonia up to 5,000 mPa·s (BM type viscometer, 60 rev/min), applying the resulting material onto a silicone-treated

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release paper by means of Comma Bar Coater (tradename of an instrument made by Hirano Kinzoku Company) so as to give a dry film thickness of 15  $\mu\text{m}$ , drying the resulting material at 100 °C, curing it at 130 °C for 2 minutes, placing a spun-bonded nonwoven fabric of a polyester having a short fiber denier of 0.02 ( $2.222 \cdot 10^{-9}$  Kg/m) and a basis weight of 20 g/m<sup>2</sup> on the release paper having the thermoplastic resin composition containing the filler coated thereonto, applying the latter onto the former by means of Mini Calender Roll (tradename of a roll made by Yuri Roll Machine Compny) and also subjecting these to calender processing (temperature: 20 °C; linear pressure 196.2 N/cm, and velocity: 10 m/min.) and stripping off the release paper to obtain a porous waterproof nonwoven fabric.

## Examples 2 to 5

Example 1 was repeated except that the kind and quantity of the filler were varied as indicated in Table 1 to obtain porous waterproof nonwoven fabrics.

## Comparative example 1

For comparison with the present invention, a material having removed the filler from the mixture of Example 1 was processed in the same manner as in Example 1 to obtain a waterproof nonwoven fabric.

These results are shown in Table 1.

Table 1

	Example 1	Example 2	Example 3	Example 4	Example 5	Compar. ex. 1
Organic filler	Polyethylene	Fluorine resin	Urea resin	Silicone resin	Polyester resin	None
Average particle size ( $\mu\text{m}$ )	15	25	10	20	25	-
Acrylic emulsion/organic filler	100/15	100/15	100/20	100/15	100/20	-
Calender processing	Twice	Twice	Three times	Twice	Three times	Twice
Gas-permeability (s/100cm <sup>3</sup> )	550	310	1320	410	1550	5000 or more
Water-resistant pressure Pa	9807	10787	7355	10297	8336	13729
* The ratio of acrylic emulsion to organic filler is expressed in terms of a ratio of solids contents.						

## Examples 6 to 9

As the resins used in these Examples, the following resins were prepared and used as samples for the subsequent tests:

Distilled water (100 parts by weight), potassium persulfate (0.8 part by weight), sodium dodecylsulfate (1.5 part by weight) and itaconic acid (1.0 part by weight) were introduced into an autoclave, followed by raising the temperature up to 60 °C under N<sub>2</sub> purge, thereafter continuously dropwise adding styrene (47 parts by weight), butadiene (50 parts by weight) and hydroxyethyl acrylate (2 parts by weight) to complete polymerization, neutralizing the resulting SBR latex with ammonia, and further deodorizing it by steam stripping to obtain a SBR latex having a solids content of 50 %.

This resin and polyethylene or fluorine resin each as a filler were used and the content of these fillers were varied, and applying and processing were carried out in the same manner as in Example 1 to obtain porous waterproof nonwoven fabrics. These results are shown in Table 2.

Further, for comparison with the present invention, the ratio of SBR latex to polyethylene or fluorine resin filler was changed to 100/60 (Comparative examples 2 and 3).

Table 2

	Filler	Particle size (μm)	SBR/Organic filler	Calender processing	Gas-permeability (s/100cm <sup>3</sup> )	Water-resistant pressure Pa	
5	Example 6	Polyethylene	15	100/ 5	Twice	1200	11768
	Example 7	"	15	100/30	Twice	380	8336
	Example 8	Fluorine resin	25	100/ 5	Twice	720	10297
10	Example 9	"	25	100/30	Twice	210	8826
	Compar. ex. 1	None	-	100/ 0	Twice	5000 or more	13729
	Compar. ex. 2	Polyethylene	15	100/60	Twice	170	2452
15	Compar. ex. 3	Fluorine resin	25	100/60	Twice	120	2942
* The ratio of SBR latex to organic filler is expressed in terms of the ratio of solids contents.							

#### 20 Examples 10 to 14

The acrylic emulsion of butyl acrylate, etc. (solids content: 40 %) used in Example 1 was used as a thermoplastic resin, and polyethylene or a silicone resin, each having the average particle diameter varied, was used as a filler, and applying and processing were carried out in the same manner as in Example 1, but varying the thickness of coating to obtain porous waterproof nonwoven fabrics. These results are shown in Table 3.

In addition, the ratio of the acrylic emulsion to the organic filler was set to 100/15.

Table 3

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	Filler	Particle size (μm)	Dry film thickness (μm)	Frequency of calendering	Gas-permeability (s/100cm <sup>3</sup> )	Water-resistant pressure Pa
Example 10	Polyethylene	3	15	Twice	1310	13729
Example 11	Polyethylene	40	20	Twice	480	6374
Example 12	Silicone resin	35	20	Twice	550	7355
Example 13	Polyethylene	0.5	15	Twice	4600	13729
Example 14	Polyethylene	60	30	Twice	290	5394

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#### Examples 15 to 18

45 Polyethylene (average particle size: 15 $\mu$ ) was used as a filler and various kinds of nonwoven fabrics indicated in Table 4 were used each as a base, and applying and processing were carried out in the same manner as in Example 1 to obtain composite porous waterproof nonwoven fabrics.

#### 50 Comparative example 4

Example 18 was repeated except that the nonwoven fabric was replaced by a nylon taffeta (440g warp yarns/m and 381g weft yarns/m) to obtain a composite porous waterproof cloth.

#### 55 Comparative example 5

Example 4 was repeated except that the nonwoven fabric was replaced by a sized paper obtained by subjecting a paper of 100 % pulp to post-processing with a wax sizing agent and having a basis weight of 25 g/m<sup>2</sup>, to obtain a composite porous waterproof paper.



Comparative example 6

For comparison with the present invention, the thermoplastic resin film in advance of being applied onto the nonwoven fabric obtained in Example 1 and not subjected to calender processing was stripped from the release paper, followed by applying it onto the nonwoven fabric, to measure the gas-permeability and water-resistant pressure. These results are shown in Table 4.

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Table 4

	Example 15	Example 16	Example 17	Example 18	Compar. ex. 4	Compar. ex. 5	Compar. ex. 6
Substrate	Nonwoven fabric	Nonwoven fabric	Nonwoven fabric	Nonwoven fabric	Nylon taffeta	Sized paper	Nonwoven fabric
Denier (Kg/m)	2.222.10 <sup>-3</sup>	2.222.10 <sup>-3</sup>	2.222.10 <sup>-8</sup>	8.888.10 <sup>-9</sup>			2.222.10 <sup>-9</sup>
Basis weight (g/m <sup>2</sup> )	20	20	40	45		25	20
Stock	Polyester	Polyester	Polyester	Nylon			Polyester
Acrylic emulsion/Polyethylene	100/15	100/15	100/15	100/15	100/15	100/15	100/15
Frequency of calendaring	3 times	4 times	Twice	Twice	Twice	Twice	0
Gas-permeability (s/100cm <sup>3</sup> )	430	320	560	400	470	980	5000 or more
Water-resistant pressure Pa	8336	6374	8826	10787	7845	10787	13729
Feeling	○	△	○	⊙	X	X	⊙

As to the measurement of the feeling, evaluation was carried out according to a feeling test by hand.

⊙ : very soft feeling ○ : soft feeling

△ : somewhat stiff feeling X : stiff feeling

Example 19

The acrylic emulsion of butylacrylate, etc. containing polyethylene filler used in Example 1 was applied directly onto the nonwoven fabric used in Example 20 by means of a roll over knife coater so as to give a dry film thickness of 15  $\mu\text{m}$ , followed by drying the resulting material and subjecting it to processing under the same calender conditions as in Example 1 to obtain a porous waterproof nonwoven fabric.

This porous nonwoven fabric had a gas-permeability of 380 seconds/100  $\text{cm}^3$ , a water-resistant pressure of 7845 Pa and a very soft feeling.

The porous waterproof nonwoven fabric provided according to the present invention is usable for clothes, waterproof covers, hygienic materials such as diaper, garments such as surgical gown, rain coat, etc. and also usable for disposable uses.

**Claims**

1. A porous composite nonwoven fabric which comprises a nonwoven fabric and a thermoplastic film comprising 100 parts by weight of a thermoplastic resin and 1 to 50 parts by weight of an organic filler, having particle size of 1 to 50  $\mu\text{m}$ , porosity being obtainable by subjecting said thermoplastic film, alone or in conjunction with the nonwoven fabric, to calender processing thereby forming pores of 0.1-10  $\mu\text{m}$  in dimension therein.
2. A porous composite nonwoven fabric according to claim 1 wherein the dimension of pores is comprised in the range of 0.5-5  $\mu\text{m}$ .
3. A porous composite nonwoven fabric according to claim 1 wherein said thermoplastic resin is at least one member selected from the group consisting of acrylic resins, urethane resins, synthetic rubbers, ethylene-vinyl acetate copolymer resins.
4. A porous composite nonwoven fabric according to claim 1 wherein said filler is at least one member selected from the group consisting of fluorine resins, silicone resins, polyethylene and polypropylene.
5. A porous composite nonwoven fabric according to claim 1 wherein said nonwoven fabric is at least one member selected from the group consisting of wet nonwoven fabric, spun-bonded nonwoven fabric, needle-punched nonwoven fabric, spun rayon nonwoven fabric and hot-melt-adhesive nonwoven fabric.
6. A porous composite nonwoven fabric according to claim 1 wherein fibers constituting said nonwoven fabric are polyester fibers, nylon fibers, polyacrylic fibers, polyolefin fibers or rayon fibers, these fibers being used singly or in admixture.
7. A process for producing a porous composite nonwoven fabric, the dimension of pores ranging between 1-10  $\mu\text{m}$ , which process comprises subjecting to calender processing a thermoplastic film comprising 100 parts by weight of a thermoplastic resin and 1 to 50 parts by weight of an organic filler, having particle size of 1 to 50  $\mu\text{m}$ , followed by applying a nonwoven fabric onto the resulting film.
8. A process for producing a porous composite nonwoven fabric, the dimension of pores ranging between 1-10  $\mu\text{m}$ , which process comprises applying a thermoplastic film comprising 100 parts by weight of a thermoplastic resin and 1 to 50 parts by weight of an organic filler, having particle size of 1 to 50  $\mu\text{m}$ , onto a nonwoven fabric, followed by subjecting the resulting material to calender processing.
9. A process for producing a porous composite nonwoven fabric, the dimension of pores ranging between 1-10  $\mu\text{m}$ , which process comprises coating a nonwoven fabric with a thermoplastic resin composition comprising 100 parts by weight of a thermoplastic resin and 1 to 50 parts by weight of an organic filler, having particle size of 1 to 50  $\mu\text{m}$ , followed by subjecting the resulting material to calender processing.

# Patentansprüche

1. Poröses Verbund-Faservlies, welches ein Faservlies und eine thermoplastische Folie umfaßt, die 100 Gewichtsteile eines thermoplastischen Harzes und 1 bis 50 Gewichtsteile eines organischen Füllmaterials, das eine Teilchengröße von 1 bis 50  $\mu\text{m}$  besitzt, enthält, wobei die Porosität durch Kalandrieren der thermoplastischen Folie allein oder zusammen mit dem Faservlies erhältlich ist, wobei in dieser Poren mit einer Größe von 0,1 bis 10  $\mu\text{m}$  gebildet werden.
2. Poröses Verbund-Faservlies nach Anspruch 1, worin die Größe der Poren im Bereich von 0,5 bis 5  $\mu\text{m}$  liegt.
3. Poröses Verbund-Faservlies nach Anspruch 1, worin das thermoplastische Harz mindestens ein aus der aus Acrylharzen, Urethanharzen, synthetischen Kautschuken, Ethylen-Vinylacetat-Copolymerharzen bestehenden Gruppe ausgewähltes Harz ist.
4. Poröses Verbund-Faservlies nach Anspruch 1, worin das Füllmaterial mindestens ein aus der aus Fluorharzen, Siliconharzen, Polyethylen und Polypropylen bestehenden Gruppe ausgewähltes Material ist.
5. Poröses Verbund-Faservlies nach Anspruch 1, worin das Faservlies mindestens ein aus der aus Naß-Faservlies, versponnenem Faservlies, genadeltem Faservlies, Kunstseide-Faservlies und Schmelzkleber-Faservlies bestehenden Gruppe ausgewähltes Faservlies ist.
6. Poröses Verbund-Faservlies nach Anspruch 1, worin die das Faservlies bildenden Fasern Polyesterfasern, Nylonfasern, Polyacrylfasern, Polyolefinfasern oder Rayonfasern sind, wobei diese Fasern einzeln oder im Gemisch verwendet werden.
7. Verfahren zur Herstellung eines porösen Verbund-Faservlieses, dessen Porengröße zwischen 1 bis 10  $\mu\text{m}$  liegt, welches umfaßt:  
Kalandrieren einer thermoplastischen Folie, die 100 Gewichtsteile eines thermoplastischen Harzes und 1 bis 50 Gewichtsteile eines organischen Füllmaterials, das eine Teilchengröße von 1 bis 50  $\mu\text{m}$  besitzt, enthält, und nachfolgend Aufbringen eines Faservlieses auf die so erhaltene Folie.
8. Verfahren zur Herstellung eines porösen Verbund-Faservlieses, dessen Porengröße im Bereich von 1 bis 10  $\mu\text{m}$  liegt, welches umfaßt:  
Aufbringen einer thermoplastischen Folie, die 100 Gewichtsteile eines thermoplastischen Harzes und 1 bis 50 Gewichtsteile eines organischen Füllmaterials, das eine Teilchengröße von 1 bis 50  $\mu\text{m}$  besitzt, enthält, auf ein Faservlies, und nachfolgend Kalandrieren des so erhaltenen Materials.
9. Verfahren zur Herstellung eines porösen Verbund-Faservlieses, dessen Porengröße im Bereich von 1 bis 10  $\mu\text{m}$  liegt, welches liegt:  
Beschichten eines Faservlieses mit einer thermoplastischen Harzzusammensetzung, die 100 Gewichtsteile eines thermoplastischen Harzes und 1 bis 50 Gewichtsteile eines organischen Füllmaterials, das eine Teilchengröße von 1 bis 50  $\mu\text{m}$  besitzt, enthält, und nachfolgend Kalandrieren des so erhaltenen Materials.

## Revendications

1. Etoffe non tissée composite poreuse, qui comprend une étoffe non tissée et une pellicule thermoplastique comprenant 100 parties en poids d'une résine thermoplastique et 1 à 50 parties en poids d'une charge organique dont la taille particulière va de 1 à 50  $\mu\text{m}$ , la porosité pouvant être obtenue par soumission de ladite pellicule thermoplastique, seule ou en association avec l'étoffe non tissée, à un traitement de calandrage qui y forme des pores ayant de 0,1 à 10  $\mu\text{m}$ .
2. Etoffe non tissée composite poreuse selon la revendication 1, dans laquelle la dimension des pores est comprise entre 0,5 et 5  $\mu\text{m}$ .

3. Etoffe non tissée composite poreuse selon la revendication 1, dans laquelle ladite résine thermoplastique est constituée par au moins un membre du groupe consistant en des résines acryliques, des résines d'uréthane, des caoutchoucs synthétiques, des résines d'un copolymère d'éthylène/acétate de vinyle.
- 5 4. Etoffe non tissée composite poreuse selon la revendication 1, dans laquelle ladite charge est constituée par au moins un membre du groupe consistant en des résines fluorées, des résines de silicone, du polyéthylène et du polypropylène.
- 10 5. Etoffe non tissée composite poreuse selon la revendication 1, dans laquelle ladite étoffe non tissée est constituée par au moins un membre du groupe consistant en de l'étoffe non tissée humide, de l'étoffe non tissée en nappe, de l'étoffe non tissée aiguilletée, de l'étoffe non tissée en rayonne filée et de l'étoffe non tissée comportant de l'adhésif fusible à chaud.
- 15 6. Etoffe non tissée composite poreuse selon la revendication 1, dans laquelle les fibres constituant ladite étoffe non tissée sont des fibres de polyester, des fibres de "Nylon", des fibres polyacryliques, des fibres d'une polyoléfine ou des fibres de rayonne, ces fibres étant utilisées isolément ou en mélange.
- 20 7. Procédé pour produire une étoffe non tissée composite poreuse, dont les dimensions des pores se situent entre 1 et 10  $\mu\text{m}$ , ce procédé comprenant la soumission à une opération de calandrage d'une pellicule thermoplastique comprenant 100 parties en poids d'une résine thermoplastique et 1 à 50 parties en poids d'une charge organique, ayant une taille particulière de 1 à 50  $\mu\text{m}$ , opération suivie de l'application, sur la pellicule résultante, d'une étoffe non tissée.
- 25 8. Procédé pour produire une étoffe non tissée composite poreuse, dont les pores ont une dimension comprise entre 1 et 10  $\mu\text{m}$ , ce procédé comprenant l'application d'une pellicule thermoplastique, comprenant 100 parties en poids d'une résine thermoplastique et 1 à 50 parties en poids d'une charge organique, ayant une taille particulière de 1 à 50  $\mu\text{m}$ , sur une étoffe non tissée, opération suivie de la soumission de la matière résultante à un traitement de calandrage.
- 30 9. Procédé pour produire une étoffe non tissée composite poreuse, dont les dimensions des pores se situent entre 1 et 10  $\mu\text{m}$ , ce procédé comprenant l'application en revêtement, sur une étoffe non tissée, d'une composition de résine thermoplastique comprenant 100 parties en poids d'une résine thermoplastique et 1 à 50 parties en poids d'une charge organique, et ayant une taille particulière de 1 à 50  $\mu\text{m}$ , opération suivie de la soumission de la matière résultante à un traitement de calandrage.
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